

R E M A R K S

Claims 1-17 are pending in this application.

Support for the changes to claim 1 is found at page 7, lines 15-17 of the specification. Support for the changes to claims 5 and 6 is found at page 3, lines 21-23. Support for the changes to claim 9 is found at page 1, line 15. Support for the change to claim 10 is found at the last paragraph of page 1. Claim 12 has been amended so as to be consistent with claim 4. Claim 17 has been amended so as to be placed into independent form. Support for the changes to the specification is found in the original claims. Also, some corrections or changes to allow for consistency were made to the specification.

Allowable Claims 16 and 17

Claims 16 and 17 were indicated to be allowable and were objected to as being dependent upon rejected base claims. It is noted that original claim 16 is an independent claim. In any case, independent claims 16 and 17 have now been placed into allowable condition.

Issues under 35 U.S.C. 112

Claims 5, 6, 10, 11 and 15 have been rejected under 35 U.S.C. 112, second paragraph, as allegedly being indefinite because of the phrase "high impact polystyrene". Claim 17 has been rejected because of an incorrect spelling of the term "melting". Claim 9 has been rejected for failing to define the functional consequences of an "effective amount" recited in the claims.

Regarding claims 5, 6, 10, 11 and 15, attention is directed to enclosed Exhibit A, which establishes that a "high impact polystyrene" is generally recognized to be the product of polymerization of an unsaturated rubber, such as polybutadiene, dissolved in styrene in a solution or mass-suspension process. Consequently, it is submitted that the listing of "high impact polystyrene" in these claims is completely consistent with the base claims from which these dependent claims depend from. Regarding claim 17, the term "melting" has been corrected. Regarding claim 9, the functional consequences of an "effective amount" have been inserted into this claim.

In view of the above, it is submitted that all of the presently pending claims comply with all requirements under 35 U.S.C. 112, such that the above-noted rejection should be withdrawn.

Issues under 35 U.S.C. 102(e), 102(b) and 103(a)

Claims 1-15 have been rejected under 35 U.S.C. 102(e) or, in the alternative, under 35 U.S.C. 103(a) as being unpatentable over Inoue '548 (U.S. Patent 6,465,548).

Claims 1-15 have been rejected under 35 U.S.C. 102(b) or, in the alternative, under 35 U.S.C. 103(a) as being unpatentable over Inui '799 (U.S. Patent 5,665,799).

Both of the above-noted rejections are traversed for the following reasons.

Distinctions between Present Invention and Inoue '548

Inoue '548 discloses a stabilizer composition for organic polymers, which contains (a) a 6-hydroxychroman compound, among other components. Inoue '548 further discloses various synthetic organic polymers and natural organic polymers, such as, for example, at column 25, lines 50-53. Inoue '548 lists high impact polystyrene and ABS resin at column 26, lines 39 to 40. Also, Inoue '548 generically discloses a number of polymers at column 25, line 47 to column 26, line 47, as well as more specific polymer types. Further, Inoue '548 discloses in Tables 1-39 at columns 33-93 a large amount of experimental data with respect to polypropylene as an example homopolymer.

Inoue '548 fails to disclose or suggest any of the specific polymers recited in sections (a), (b) or (c) of claim 1 of the present application. As a clarification, it is noted that the compound 6-hydroxychroman actually more closely corresponds to Formula (II), rather than Formula (I). But in any case, the numerous polymers listed in Inoue '548 or the polypropylene polymer used in the experimental data portion, fail to overlap with the specific polymers recited in claim 1. It is also noted that the other claims depending from claim 1, such as amended claim 6, fail to be disclosed or suggested by Inoue '548. Finally, it is noted that Inoue '548 fails to provide any basis for a motivation to one skilled in the art to arrive at the polymer compositions encompassed by the present invention. In this regard, it is noted that the polymer compositions of the present invention exhibit advantageously satisfactory melt flow rate properties, so as to advantageously avoid gel formation. Inoue '548 fails to recognize this advantage of the present invention. Consequently, significant patentable distinctions exist between the present invention and Inoue '548, such that the above-noted rejection based on this document should be withdrawn.

Distinctions between Present Invention and Inui '799

Inui '799 discloses a rubber composition, which includes a rubber (A) and a hydroxy flavan compound (B1) represented by Formula (I). In this regard, note that Formula (I) of Inui '799 requires the presence of a dihydroxy-substituted phenyl group at a position corresponding to the substituents R<sup>9</sup> and R<sup>10</sup> in Formula (II) of claim 1 of the present application, which is the closest analogous compound recited in claim 1.

Inui '799 fails to disclose or suggest any compounds overlapping either Formula (I) or Formula (II) as recited in claim 1 of the present application. First of all, it is noted that the Office Action refers to Formula (I) of present claim 1, though this is incorrect, since the compounds of the formulae (I-1) and (I-2) require the presence of an oxy group, which does not exist in any of the compounds in Formula (I) of Inui '799. Further, the compounds of Formula (II) in claim 1 of the present application include substituents R<sup>9</sup> and R<sup>10</sup>, which do not encompass a dihydroxy-substituted phenyl group as required in Formula (I) of Inui '799. Consequently, there fails to be any overlap between any of the compounds of the Formulae (I-1), (I-2) or (II) of the claims of the present application and the compounds of Formula (I) of Inui '799. Inui '799 further fails to recognize the advantages achieved by the present invention as


discussed above, and fails to provide any basis for a motivation to one skilled in the art to attempt to obtain the polymer compositions of the present invention. Therefore, significant patentable distinctions exist between the present invention and Inui '799.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Andrew D. Meikle (Reg. No.32,868) at the telephone number of the undersigned below.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

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Attachment(s): Exhibit A

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Commercially available polystyrene-PPE blends are shown in Table 2 (see also POLY(PHENYLENE ETHERS)).

#### Blends of Polystyrene with Elastomers

One of the most successful blends is that of polystyrene and block rubbers. The combination usually results in an economical material with modest impact resistance, but low haze. Impact strength reaches a maximum at about 40 wt % styrene in the copolymer elastomer.

Polystyrene-SB blends can be fabricated by several methods: injection molding, blow molding, blown film, and sheet extrusion. The morphology and properties are greatly dependent on fabrication conditions, with higher shear fields yielding smaller particles (Table 3).

Table 3. Properties of Polystyrene Blends<sup>a</sup> with Polystyrene-SB Block Copolymers

	Stereon 874 <sup>b</sup>	KR05 <sup>c</sup>
Polystyrene, %	50	40
Impact (method B), g	315	350
Flex (0.046-cm specimen),	250	500
Impact endurance, cycles to failure		
Elastic modulus, MPa <sup>d</sup>	104	106
Stress at yield, MPa <sup>d</sup>	36	36
Extrusion (1.3 cm/min), %	<10	<15

<sup>a</sup> Extruded sheet.

<sup>b</sup> Stereone Synthetic Rubber and Latex Co. (multiblock, 70% styrene).

<sup>c</sup> Phillips Petroleum Co. (radial block).

<sup>d</sup> Convert MPa to psi, multiply by 145.

#### Blends of SAN and ABS with PC

Commercial products based on PC and ABS blends were introduced several years ago and have gained popularity among fabricators. The principal macromolecular components are immiscible with one another. Despite the immiscibility, an excellent balance of properties occurs in the region of 35–65 wt % PC.

Another study of the effect of processing conditions on the morphology of the fabricated part showed that the final blend morphology is determined primarily by the last fabrication step. The best morphology is a colamellar state achieved with 65 vol % PC. The toughness of PC-ABS blends is optimized when a colamellar state is achieved (see also POLYCARBONATES).

#### Polystyrene-co-maleic anhydride) Blends

Terpolymers of styrene-maleic anhydride-acrylonitrile, styrene-maleic anhydride-methyl methacrylate, styrene-maleic anhydride-ethyl acrylate, and styrene-maleic anhydride-isobutylene have been blended with ABS resins and properties determined. Blending maleic anhydride terpolymers with ABS allows the potential of increased solvent resistance, toughening, modified processability, and improved distortion properties.

#### Blends of Polystyrene with Polyethylene

The crystalline nature of polyolefins is responsible for a very sharp change in viscosity at the melting point. This forces the processor to take special measures when attempting to ther-

moform these resins. The potential fabrication benefits from blending with polystyrene have encouraged many studies in both industrial and academic laboratories.

#### BIBLIOGRAPHY

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#### HIGH IMPACT POLYSTYRENE

Polystyrene and styrene copolymers are noted for their high tensile strength and optical clarity, but they are brittle under many normal use conditions. Rubber modification opens up many markets unavailable to unmodified polystyrene.

#### Synthesis

Commercial high impact polystyrene (HIPS) products are made by polymerization of an unsaturated rubber dissolved in styrene in a solution or mass-suspension process. The rubber, generally polybutadiene, is dispersed throughout the polystyrene matrix in the form of discrete particles.

The rubber-in-styrene polymerization usually results in a superior product when compared with blended products; that is, higher modulus and equivalent impact strength are achieved with less rubber. The property improvement is due to a chemical interaction (grafting) between the growing polystyrene chains and the rubber, chemical cross-linking of the rubber, and occlusion of the continuous-phase polymer inside the rubber particles, which increases the effective volume of the rubber phase. Rubber reinforcement produces other physical property improvements such as increased elongation, ductility, and environmental stress crack resistance (ESCR). These improvements in the composite polymer are accompanied by loss of clarity and a large decrease in tensile strength and modulus from the unmodified polymer.

#### Morphology

Many electron microscopy techniques have been developed for evaluating morphology. The differences in structure among the HIPS resins are primarily a result of differences in production processes, types of rubber, and rubber concentrations. Most commercial HIPS resins have particle sizes ranging from about 1 to 10  $\mu\text{m}$ .

#### Mechanism of Rubber Reinforcement

The role of rubber in reinforcing glassy polystyrene and the mechanism of rubber particle formation have been described in detail. For HIPS the multiple craze theory seems to best explain the elongation, impact, and tensile properties of the resin, including stress whitening and the decrease in density that occurs without lateral contraction. This theory is based